

~~SECRET~~
CONSIDERED DESIGN CHANGES - WEIGHT REDUCTION1 July 1960

<u>Item</u>	<u>Current Est. Wt. (lbs)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
1. <u>Compressor Inlet Section</u>	146.2				
(a) Remove thrust balance seal (see rotor item (3 (d))		-1.9			
(b) Titanium inlet case		-38.5* prel.			
(c) Redesign #1 bearing compartment		-3			
2. <u>Compressor Stator</u>	439.5				
(a) Change 1st Stage comp. case, vanes to Titanium		-27.2* prel.			
(b) Thin inner by-pass gap fairing		-.7 prel.			
3. <u>Compressor Rotor</u>	1166				
(a) Astroloy compressor discs					-76** prel.
(b) Thin rotor flanges		-4 prel.			
(c) Incorporate Inco 718 in blades and shorten rotor					-18 prel.
(d) Remove 1st Stage inlet seal		-3.3			
(e) Titanium 1st stage blade		-35.5* prel.			

<u>Item</u>	<u>Current Est. Wt. (lbs.)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
(f) Trussed front hub in Waspaloy with Titanium blades		-4.5*			
(g) Integral Spacers on 8th disc and shorter bolts		-10 prel.			
(h) Taper 9th stage seals		-4 prel.			
(i) Remove rear hub excess material		-4 prel.			
(j) Redesign discs 2 thru 4 to remove excess for gyro and pressure		-3.6 prel.			
4. <u>Compressor Miscellaneous</u>	6				
5. <u>Diffuser Section</u>	411				
(a) Lighten struts		-1.6 prel.			
(b) Redesign #2 bearing and bearing compartment		-24 prel.			
(c) Redesign tower shaft gearing				NA	
(d) Lightened bosses				NA	
6. <u>Burner Nozzles and Manifolds</u>	47.3				
(a) Pintle nozzles			-5 prel.		

<u>Item</u>	<u>Current Est. Wt. (lbs.)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
7. <u>Burner Cans</u>	153.8				
(a) Thin burner can supports		-1.3			
(b) Remove rear burner clamps and flange			-5 prel.		
(c) Annular burners					NA
8. <u>Outer Burner Case</u>	89.2				
(a) Reduce flanges and belts		-2 prel.			
(b) Astroloy burner case					-10** prel.
(c) Lighten drain bosses		-.3 prel.			
9. <u>Inner Burner Case</u>	55.7				
(a) Thin inner burner case corrugated stiffener to .010					-5 prel.
(b) Thin diaphragm support					NA
10. <u>Burner Miscellaneous</u>	21.6				
11. <u>Transition Ducts</u>	86.7				
(a) Thin outer duct from .071 to .056" min.			-9		

Item	Current Est. Wt. (lbs)	Proposed Changes (lbs)			
		Cat. 1	Cat. 2	Cat. 3	Cat. 4
12. <u>Turbine Nozzles</u>	293.4				
(a) Redesign transition duct to nozzle seals			-15. prel.		
13. <u>Turbine Case</u>	91.5				
14. <u>Turbine Rotor</u>	680.1				
(a) Redesign blade root to exploit Astroloy (1st stage)		-29 prel.			
(b) Thin rotor flanges and pilots					-2 prel.
(c) Thin turbine shafts seals		-2.1 prel.			
(d) Thin 2nd stage rotor rear seal		-.7 prel.			
(e) Thin balance flange on turbine shaft		-1.4 prel.			
(f) Redesign 2nd stage root to exploit Astroloy		-5.6 prel.			
(g) Eliminate 1st stage cover plate and duct					-15 prel.
15. <u>Turbine Exhaust</u>	409.3				
(a) Sandwich const. inner turbine exhaust duct					-10** prel.
(b) Thin turbine exhaust struts to .032 min.		-2.8			

SECRET

<u>Item</u>	<u>Current Est. Wt. (lbs.)</u>	<u>Proposed Changes (lbs.)</u>			<u>Cat. 4</u>
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	
(c) Thin outer turbine exhaust ducts to .038 min.		-4.9			
(d) Astroloy rear mount ring					-10** prel.
(e) Thin turbine exhaust case rear flange		-1.3 prel.			
(f) Thin #3 bearing support flange					NA
(g) Redesign #3 bearing and bearing compartment					-3 prel.
(h) By-pass bleed re-entry					-4 prel.
16. <u>Turbine Miscellaneous</u>	12				
17. <u>A/B Diffuser Section</u>	165.5				
(a) Thin case to .032 min. Reduce flanges and bolts		-9			
(b) Sandwich construction inner cone and diaphragm					-8
(c) A/B Variable area fuel nozzles		-35 prel.			
18. <u>A/B Ducts and Liners</u>	255.9				
(a) Thin ducts		-12			

SECRET

<u>Item</u>	<u>Current Est. Wt. (lbs.)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
(b) Scallop flanges and reduce bolt sizes		-5 prel.			
(c) Substitute Astroloy sheet in duct					-15** prel.
19. <u>A/B Nozzle</u>	429.5				
(a) Reduce bolt sizes		-3.7 prel.			
(b) Waspaloy A/B nozzle support cone					NA
(c) Lighten nozzle segment rollers					-4 prel.
(d) Lighten nozzle segments with PDRL-100		-6 prel.			
(e) Thin support front flange		-4 prel.			
20. <u>A/B Actuating System</u>	40				
(a) Lighten A/B nozzle actuators					
(b) Remove A/B actuator, use 3					-5 prel.
21. <u>A/B Miscellaneous</u>	7				
22. <u>Hydraulic System</u>	105				
23. <u>Ignition System</u>	33				

SECRET

SECRET

<u>Item</u>	<u>Current Est. Wt. (lbs.)</u>	<u>Proposed Changes (lbs.)</u>			
		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
24. <u>Accessories Drive</u>	112				
(a) Gearbox		-5.8 prel.			NA
(b) Change to Ti covers and supports					
25. <u>Engine Accessories</u>	303				
(a) Lighten lube pump with Ti sheet housing					-3 prel.
(b) Titanium P & D valve housing					-2 prel.
(c) Titanium lube tank			-4 prel.		
(d) Change to controlled tubing		-5 prel.			
26. <u>A/B Accessories</u>	218				
27. <u>By-Pass System</u>	264				
(a) By-pass mechanism and ducts				-30 prel.	
(b) Eliminate front transition ducts				-23 prel.	
28. <u>Experience Factor</u>	20				
Revision in Waspaloy density	+34				
ADDITIVE TOTALS	6097	-348.6	-29	-53	-190

SECRET

SECRET

CODE : (1) Prel. = Preliminary estimate not substantiated by design layout.

(2) NA = Weight estimate not yet available.

(3) * = subject to compromise.

(4) ** = Costly material change involved.

SECRET